Physical Activity and the Human Development Index

An Honors Thesis (HONR 499)

by

Rebecca Schlesinger

Thesis Advisor

Dr. Michael Hicks

Ball State University

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Abstract

Physical inactivity is an increasing public policy issue throughout the United States. This study examines whether physical inactivity, and other wellness indicators, have an impact on the Human Development Index (HDI) of a county. The variables examined are percent of the population that is physically inactive, percent of the population that is obese, percent of population with access to exercise opportunities, number of fast food restaurants per 1000 population, percent of population that is African American, and percent of population that is Hispanic. We find that the percent of the population that is inactive and percent of the population that is obese both have a negative impact on the HDI of a county. The number of fast food restaurants per 1000 has a positive impact on the HDI of a county. None of the other variables used have a significant impact on HDI. Together, the three significant variables can explain about 43.5% of the variation in HDI.

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Process Analysis

I became fascinated by the Human Development Index (HDI) and its implications when I used it for a project at my on-campus job, as a research assistant at the Ball State Center for Business and Economic Research (CBER). The HDI is essentially a measure of how well off a society is, when compared to other societies. It is the closest and most accurate measure we have for the overall happiness of a society. This can be measured at almost any level, from city all the way to continent. I chose to look at it at the county level, because that is the index that CBER recently developed. I have always been interested in exercise and physical fitness, and I believe that being active makes a person happier. So, I decided to test my theory on a macro level, looking into how physical fitness and wellness indicators affect the HDI of a county.

Once I developed my hypothesis, I began to research similar studies and see what data and research is already available. Next, I looked into what other physical wellness indicators I could find measures for at the county level. I gathered all of my research and data, and then developed a hypothesis for each independent variable in my equation. Next I built two models and used Stata, a software program I learned in ECON 424, to run ordinary lease squares regressions. This allowed me to determine which of my variables has a significant effect on the HDI of Indiana counties.

Throughout this process I learned how to use Stata to analyze real data, without one correct answer. Up until completing this project, I had only used Stata for problems in class, where the professor created the problem and could tell me whether I got it right or wrong. In this case, there was no right answer. Not all of my hypotheses were correct, but I learned that even the incorrect still gave me valuable results.

Introduction

Physical activity is a crucial part of living a healthy lifestyle. Getting an adequate amount of exercise improves a person's healthy life expectancy tremendously by reducing risk of cardiovascular disease, type II diabetes, and some types of cancer. Additionally, it strengthens a person's bones and muscles, improves mental health, and improves ability to complete daily activities (Centers for Disease Control and Prevention, 2015).

In the United States, physical inactivity is becoming significantly more common than ever before. Only 20 percent of American adults meet the government physical activity guidelines. The current guidelines for adults age 18 to 64 is 150 minutes of moderate intensity aerobic activity and 2 or more days of muscle strengthening activities per week, or 75 minutes of vigorous intensity aerobic activity and 2 or more days of muscle strengthening activities per week.

Physical activity is not the only activity that leads to a healthy lifestyle. Another significant influence on healthy lifestyle is food consumption, both amount and type. The United States has become the fast food capital of the world, because significantly more fast food is consumed here than in any other country. In 1970, Americans spent approximately $6 billion on fast food. In 2001, Americans spent over $110 billion on fast food (Schlosser, 2002). During their lifetime, at today's averages, the average American spends more money on fast food than they do on higher education. Fast food, in general, is extremely unhealthy. It leads to many of the same affects as physical inactivity. It is much healthier for people to dine at more expensive establishments, where there are healthier options, or to purchase food at a grocery store and eat meals at home.

Amount of physical activity performed, as well as amount and types of food consumed, have a direct link to an individual's health. People with better health also tend to live a better lifestyle and have an overall higher wellness and quality of life. This study will exam whether this theory is also true at a macroeconomic level. Does the overall health and wellness of society members affect how well off the society is as a whole?

To measure how well off a society is, this study will examines the human development index (HDI). An HDI was first introduced by the United Nations Development Program in 1990. It combined a wide range of well-being indicators at the country-level. While the HDI has evolved over time, the main purpose is still to determine how well off a society is, using more than just economic measures. The three main categories of factors assessed by the HDI are health, education, and livings standards.

This study will examine if factors such as inactivity, obesity, and fast food consumption affect the HDI at the county level in Indiana. First we will look at past literature that has been written on the subject. Then we will examine the data and methods that will be performed in the study. Finally, we perform multi-linear regressions to evaluate those factors relating to health, of the HDI for a county.

Review of Literature

Quality of life and overall human development are topics that have fascinated economists throughout history. It has long since been acknowledged that health factors have a significant influence over both quality of life and human development. However, it is only since the beginning of the 21st century that exercise and food consumption have been linked to overall health and wellness. The impact of physical fitness and appropriate food consumption have become hot topics throughout the world. This is due in large part to the increasing number of obese people and the increasing number of people who do not exercise on a regular basis.

One of the first well-known and reputable studies to analyze the relationship between physical activity and health problems was completed in 1996 by the U.S. Department of Health and Human Services. It focuses on how endurance type physical activity and cardiovascular health relate to the development of diseases (U.S. Department of Health and Human Services, 1996). It concludes that physical activity does have a significant negative correlation to the development of health problems and diseases.

A similar study, completed in 2000, was conducted on a sample from Finland, and it linked physical fitness directly to mortality. Ordinary least squares regressions were used to test the significance of physical fitness as a risk factor for mortality due to cardiovascular disease, coronary heart disease, and all causes of death combined (Haapanen-Niemi, Miilunpalo, Pasanen, Vuori, Oja, & Malmberg, 2000). This is important because some of the main factors used in determining HDI are average life expectancy and years of potential life lost. If people in a given region are dying due to lack of physical activity, this will likely cause the average life expectancy to decrease and the years of potential life lost to increase, ultimately lowering the HDI.

Consumption of large amounts of fast food and obesity also have a negative effect on health. The higher the sales of the fast food industry are, the more likely the people in that area will have poor health. Additionally, the increased consumption of fast food leads to obesity, in this study that is anyone with a BMI over 25 (Adams, 2005). Obesity is one of the leading causes for poor health and premature death, meaning it will also have a significant effect on the health index of the HDI.

Recently, there has been an increasing number of studies focusing on the relationship between physical activity and quality of life. Cross-sectional data from a variety of sources shows that there is a consistent positive correlation between self-reported physical activity and quality of life. Specifically, people were reported as being physically active if they reported having less than 14 unhealthy days without exercise during the past month (Bize, Johnson, & Plotnikoff, 2007). A similar conclusion resulted from a study completed in Hong Kong, linking obesity and physical activity to quality of life. A comprehensive quality of life metric was devised, consisting of factors related to physical functioning, role limitation due to physical problems, bodily pain, general health, vitality, social functioning, role limitation due to emotional problems, mental health, and change of health condition with time. It was found that obesity and physical inactivity both have a significant negative correlation with a person's quality of life measure (Ko, 2006).

Most studies that examine the relationship between physical fitness, eating habits, and overall wellness have been conducted at the microeconomic level. There are a large number of studies that show that physical activity has a positive and significant correlation with quality of life and fast food consumption and obesity both have a negative and significant correlation with quality of life (Aidar, et al., 2011) (Bize, Johnson, & Plotnikoff, 2007) (Pucci, Rech, Fermino, & Reis, 2012) (Romain, Bernard, Attalin, Gernigon, Ninot, & Avignon, 2012) . Quality of life is very similar to HDI in that they are both comprehensive measures of well-being, created to include more than just economic factors. However, HDI is calculated at a macro-economic level while quality of life focuses on individuals. Therefore, it is likely that we will find similar results for the relationship between physical fitness, obesity, and HDI that previous studies have found between physical fitness, obesity, and quality of life.

There have been a few studies completed that link exercise and physical health factors to the HDI, all at a country level. It has been shown that physical inactivity is more prevalent in countries with a high HDI than countries with a low HDI. Additionally, the variability in the prevalence of physical activity is higher in countries that have a low HDI (Dumith, Hallal, Reis, & Kohl, 2011). Contrarily, another study finds that for low and middle-income countries, increased HDI levels are correlated negatively with physical inactivity (Atkinson, Lowe, & Moore, 2015). This confliction is likely due to the countries included in each study. The first includes mostly developed nations, while the second only includes developing and undeveloped nations.

One of the significant influences of multidimensional human development is found to be play, which is measured as the opportunity to enjoy recreation and activities (Alkire, 2002). Additionally, it has been shown that the number of people who exercise at sports clubs can be used as a proxy for the percentage of the population which exercises on a regular basis, and this also has a positive effect on the HDI at the country level (Modranka & Suchecka, 2014).

All of the past literature influences the structure and variables that will be used in this paper. We will look at a combination of all the physical wellness indicators used in past studies and regress them against the HDI.

Data and Methodology

The purpose of this research study is to determine if physical wellness indicators affect the HDI at the county level. We specifically want to see how exercise, physical activity, and prevalence of fast food affect the HDI. Additionally, we will examine if race and ethnicity of a population have any effect on its HDI.

The HDI measure that we will use in this study is one developed in 2014 by the staff at the Ball State Center for Business and Economic Research. This measure includes composite indexes of health, education, and standard of living for each county. The health index is estimated using the average life expectancy at birth and years of potential life gained indicators. The education index is estimated using both the education enrollment and the education attainment. The living standards index is measured using the per capita income and the average monthly earnings for each county (Devaraj, Sharma, Hicks, & Faulk, 2015). The HDI data we will use for this study is based on 2014 indicators.

Based on the review of past literature, the independent variables we will focus on are physical inactivity, adult obesity, access to exercise opportunities, prevalence of fast food restaurants, race, and ethnicity. These six independent variables will be measured against one dependent variable, HDI. The main regression equation we will use is:

$$HDI_i = \beta_0 + \beta_1 INAC + \beta_2 OBES + \beta_3 EXER + \beta_4 FAST + \beta_5 AFRI + \beta_6 HISP$$

The INAC variable is the percentage of adults age 20 and over that reports no leisure time activity. This data was collected by the Center for Disease Control and Prevention, through its Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a telephone survey of the adult population, and it is conducted on a monthly basis. To be included in the percent in a county considered inactive, a participant must have responded no to the question "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?"(Center for Disease Control and Prevention, 2016).

The OBES variable is the percentage of adults age 20 and over that has a body mass index (BMI) of greater than 30 kg/m^2. This data is also taken from the BRFSS conducted by the Center for Disease Control and Prevention. To be included in this percentage, an individual must report a BMI of greater than 30, and because most people do not know their BMI, it was derived from a self-report of current height and weight (Center for Disease Control and Prevention, 2016).

EXER is the measure of the percentage of people in a county who have access to exercise opportunities. This includes people who live reasonably close to parks or recreational facilities at which they can exercise. This data is found using the ArcGIS Business Analyst program (County Health Rankings, 2014). The data used to find the percentage of people with access is all from the year 2014.

FAST is the number of fast food restaurants per 1000 population in the county. This data is collected by the United States Department of Agriculture Economic Research Service. The restaurants which are considered fast food are those which are classified as limited service restaurants by the North American Industry Classification System (NAICS). This includes any restaurant establishments that primarily have patrons that order and pay before eating (United States Department of Agriculture, 2015).This number of restaurants is then divided by the population times a thousand to get the actual data used. The most recent data available for this indicator is 2012. This is a proxy for the amount of people in a county who regularly eat at fast food restaurants. We assume that the higher the ratio is between fast food restaurants and the population, the higher the percentage of residents who frequent those restaurants is.

The indicator AFRI is the percent of the population that is African American. HISP is the percent of the population that is Hispanic. Both of these indicators are collected by the United States Census Bureau, through its American Community Survey.

Table 1 illustrates all of the variables and data described above. This dataset will be used to run regressions and analyze the effects of the independent variables on HDI, the dependent variable.

Table 1

Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
HDI	92	53.18	16.42	0	100
INAC	92	28.17	3.45	16.3	34.4
OBES	92	32.36	2.81	22.1	38.2
EXER	92	60.52	17.55	12.99	92.16
FAST	92	0.61	0.20	0	1.16
AFRI	92	2.64	4.44	0.06	26.90
HISP	92	3.61	3.30	0.07	17.40

Before analyzing the specific data, we will hypothesize what the signs of the coefficients for the independent variables will be. Later, we will use these hypotheses to form tests determining the significance of the data.

The higher the percentage of people who are physically inactive is, the less healthy a society is going to be. The less healthy the people in a county are, the lower the HDI will be. This leads to the thought that $\beta_1$will be negative. Due to similar reasoning, we believe that β_2 will also be negative. The more people that are obese, the more people there are at risk for serious medical issues such as heart attacks and certain types of cancer.

People tend to exercise more and live a healthier lifestyle when there are parks, paths, recreation centers, or other places to work out at a convenient location from their home. For this reason we hypothesize that β_3, percent with access to exercise opportunities, will positively influence the HDI of a county.

β_4, fast food as a ratio to population, is likely to have a negative influence on the HDI of a county. This is because the more fast food a person eats, the more likely they are to live poorly and maintain a lower standard of living. Counties that have a significant portion of the population which frequents fast food restaurants will likely be the same counties that are less well-off than others.

The final two independent variables, β_5 and β_6, are the percentage of the population that are African American and the percentage of the population that are Hispanic. These estimates are difficult to predict, but it is likely that they will both be slightly negative because white people tend to have a higher living standard and live in areas with a higher HDI than minorities.

In the next section we will run an ordinary least squares regression on the model from above. We will then analyze the findings and determine whether our hypotheses were correct.

Regressions and Analysis

Using the above equation and data, we are able to create an estimated equation, using Stata to run an ordinary least squares regression. Table 2 illustrates the coefficient, standard error, and p-value for all of the independent variables.

Table 2

Independent Variables

	Coefficient (P-value)	Standard Error
Constant	126.97*** (0.00)	20.61
INAC	-1.93*** (0.00)	0.46
OBES	-1.16** (0.03)	0.53
EXER	0.07 (0.48)	0.10
FAST	21.90** (0.01)	7.63
AFRI	0.03 (0.93)	0.38
HISP	0.03 (0.94)	0.48

Note: *** denotes statistical significant at the 0.01 level, ** denotes statistical significance at the 0.05 level, and * denotes statistical significance at the 0.10 level using standard t-statistics

The estimated equation is:

$$HDI = 126.97 - 1.93INAC - 1.16OBES + .07EXER + 21.90FAST + .03AFRI + .03HISP$$

This equation has a R^2 of 0.44 and an adjusted R^2 of 0.40. This means that approximately 40 percent of the variance in HDI between Indiana counties can be explained by inactivity, obesity, access to exercise, fast food available, percent African American, and percent Hispanic.

The p-values for access to exercise opportunities, percent African American, and percent Hispanic are all extremely high, meaning that they likely do not have a significant effect on HDI or they are highly correlated with one or more of the other independent variables. The correlation of variables is illustrated in Table 3 below.

Table 3

Correlation Matrix

	HDI	INAC	OBES	EXER	FAST	AFRI	HISP
HDI	1.00						
INAC	-0.55	1.00					
OBES	-0.42	0.42	1.00				
EXER	0.41	-0.40	-0.29	1.00			
FAST	0.37	-0.12	-0.12	0.40	1.00		
AFRI	0.18	-0.14	-0.01	0.47	0.28	1.00	
HISP	0.22	-0.21	-0.02	0.28	0.36	0.48	1.00

HDI has a high correlation with inactivity, obesity, access to exercise, and fast food, meaning these variables have the highest effect on HDI. However, there is also high correlation between several sets of independent variables, including inactivity and obesity, inactivity and access to exercise, access to exercise and fast food available, access to exercise and percent African American, fast food available and percent African American, and percent African American and percent Hispanic.

Due to the high p-values of access to exercise, percent African American, and percent Hispanic, and there high correlations to other independent variables, we created a restricted model, taking those variables out of the equation.

$$HDI_i = \beta_0 + \beta_1 INAC + \beta_2 OBES + \beta_3 FAST$$

Using an ordinary least squares regression, we conducted a joint hypothesis test on the restrictions. According to the test, access to exercise, percent African American, and percent Hispanic do not have explanatory power; they can be removed from the equation. Therefore, the resulting estimated equation is:

$$HDI = 134.82 - 2.05INAC - 1.20OBES + 24.49FAST$$

The R^2 for this equation is 0.435 and the adjusted R^2 is 0.42. The explanatory power of the restricted equation is very similar to the explanatory power of the original, unrestricted equation. Additionally, all of the p-values in the restricted model are close to zero, meaning the variables all have a significant impact on HDI. This, along with the coefficients and standard errors of the remaining independent variables, is illustrated in Table 4.

Table 4

Restricted Model Independent Variables

	Coefficient (P-value)	Standard Error
Constant	134.82*** (0.00)	17.15
INAC	-2.05*** (0.00)	0.42
OBES	-1.20** (0.02)	0.52
FAST	24.49*** (0.00)	6.66

Note: *** denotes statistical significant at the 0.01 level, ** denotes statistical significance at the 0.05 level, and * denotes statistical significance at the 0.10 level using standard t-statistics

As we hypothesized, inactivity has a negative impact on HDI. The more active the people in a county are, the higher the HDI will be. According to the estimated equation, when the percent of inactive people in a county increases by one, the HDI will decrease by 2.05, as long as all other variables stay the same.

Our hypothesis about obesity was also correct. The higher the percentage of obese people living in a county, the lower its HDI will be. Based on the estimated equation, the HDI will decrease by 1.20 each time the percentage of obese people in a county increases by one, given all other variables stay the same.

Number of fast food establishments has the opposite effect on HDI than what we hypothesized. We predicted that more fast food restaurants per 1000 population would lead to increased fast food consumption. This would have a negative impact on the HDI because fast food consumption leads to poor health. However, the regression shows that fast food restaurants have a positive impact on the HDI. As the fast food restaurants per 1000 population increases by one, the HDI of a county will increase by 24.49, given all other variables stay the same. This is likely the case because counties with more fast food restaurants also tend to be more developed and urban counties. These counties have higher living standards, leading to them also having higher HDIs than rural and less populated counties.

Conclusion

This research study analyzes the impacts of physical wellness and health indicators on the HDI of Indiana counties. The HDI measure used in this study was created as a multidimensional index including a range of well-being indicators by the Ball State Center for Business and Economic Research. The independent variables included in the first equation are the percent of the population that is inactive, the percent of the population that is obese, the percent of the population that has access to exercise opportunities, the number of fast food restaurants per 1000 population, the percent of the population that is African American, and the percent of the population that is Hispanic.

We find that the only variables with explanatory power are the percent of the population that is inactive, the percent of the population that is obese, and the number of fast food restaurants per 1000 population. Inactivity and obesity have a negative, significant impact on a county's HDI. Fast food restaurants have a positive influence on a county's HDI.

The key takeaway from this is that the more people participate in physical activity and the more they keep themselves from becoming obese, the better off their society will be as a whole. Inactivity and obesity are at an all-time high throughout America, with less than a quarter of adults meeting the recommended exercise amounts. If more adults begin to exercise on a regular basis, not only will their health improve, but the overall wellness and HDI of their county will also improve.

Further Research

A suggestion for further research on this topic is to conduct a similar study using all counties throughout the U.S. to see if the findings are consistent with those in just Indiana. Additionally, a study could be created with more reliable results by measuring inactivity and obesity in a way other than through self-reports. Another interesting topic for further research is to measure the percent of the population that eats fast food on a regular basis, rather than the number of fast food restaurants per 1000 population, to determine if this would lead to results similar to the current study or to our original hypothesis. It would also be interesting to extend this study across more heterogeneous regions than Indiana would, and to evaluate these effects on smaller geographies such as Census tracts.

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Appendices

Appendix A: Literature Review

Author	Article Title	Abstract	Notes
Dumith, Samuel and Pedro Hallal and Rodrigo Reis and Harold Kohl	Worldwide Prevalence of Physical Inactivity and its Association with Human Development Index in 76 countries	"The objective is to describe the worldwide prevalence of physical inactivity and to analyze its association with development level of each country. We pooled analysis of three multicenter studies, conducted between 2002 and 2004, which investigated the prevalence of physical inactivity in 76 countries, and comprised almost 300,000 individuals aged 15 years or older. Each study used the International Physical Activity Questionnaire to assess physical inactivity. The level of development of each country was analyzed by the Human Development Index (HDI). Results. The crude worldwide prevalence of physical inactivity was 21.4% (95%CI 18.4–24.3). It ranged from 2.6% (in Comoros) to 62.3% (in Mauritania), with a median equal to 18%. After weighting for the total population of each country, the worldwide prevalence of physical inactivity was 17.4% (95%CI 15.1–19.7). There was a positive association between HDI and prevalence of physical inactivity (rho= 0.27). Less developed countries showed the lowest prevalence of physical inactivity (18.7%), while physical inactivity was more prevalent among the most developed countries (27.8%). In conclusion, physical inactivity was more prevalent among wealthier and urban countries, and among women and elderly individuals."	Looks at the correlation between physical inactivity and HDI of countries. Broken into categories of high, medium, and low HDIs. The variability in physical inactivity is higher in countries with a low HDI. Shows a positive relationship between physical inactivity and HDI. Physical inactivity is more prevalent among developed countries than among undeveloped countries.
Devaraj, Srikant and Sushil Sharma and Michael Hicks and Dagney Faulk	The Human Development of Indiana Counties: A Policy Perspective	"In this report, we find the Human Development Index of all 92 counties in Indiana, building upon a detailed construction of the HDI by Devaraj, et. al. (2014). We extend this work by analyzing the Human Development Index at the regional and metropolitan areas within the state. We also provide a frame-work for policy considerations for Indiana, and offer qualitative comparisons to the existing county-level rankings in Indiana."	Explains the measure of HDI at a county level. It combines a health index, education index, and living standards index to create a comprehensive HDI.

Atkinson, Kaitlin and Samantha Lowe and Spencer Moore	Human Development, Occupational Structure and Physical Inactivity Among 47 Low and Middle Income Countries	"This study aimed to (a) assess the relationship between a person's occupational category and their physical inactivity, and (b) analyze the association among country-level variables and physical inactivity. The World Health Survey (WHS) was administered in 2002–2003 among 47 low- and middle-income countries (n = 196,742).The International Physical Activity Questionnaire (IPAQ) was used to collect verbal reports of physical activity and convert responses into measures of physical inactivity. Economic development (GDP/c), degree of urbanization, and the Human Development Index (HDI) were used to measure country-level variables and physical inactivity. Multilevel logistic regression analysis was used to examine the association among country-level factors, individual occupational status, and physical inactivity. Overall, the worldwide prevalence of physical inactivity in 2002–2003 was 23.7%. Individuals working in the white-collar industry compared to agriculture were 84%more likely to be physically inactive (OR: 1.84, CI: 1.73–1.95). Among low- and middle-income countries in-creased HDI values were associated with decreased levels of physical inactivity (OR: 0.98, CI: 0.97–0.99). As countries experience economic development, changes are also seen in their occupational structure, which result in increased countrywide physical inactivity levels."	Shows that there is a negative correlation between HDI and physical inactivity in low and middle income countries. This means that the higher the HDI, the lower the odds of physical inactivity.
Aidar, Felipe and Ricardo de Oliveira and Antonio Silva and Dihogo Matos and Andre Carneiro and	The Influence of the Level of Physical Activity and Human Development in the Quality of Life in Survivors of Stroke	"Background: The association between physical activity and quality of life in stroke survivors has not been analyzed within a framework related to the human development index. This study aimed to identify differences in physical activity level and in the quality of life of stroke survivors in two cities differing in economic aspects of the human development index. Methods: Two groups of subjects who had suffered a stroke at least a year prior to testing and showed hemiplegia or hemiparesis were studied: a group from Belo Horizonte (BH) with 48 people (51.5 ± 8.7 years) and one from Montes Claros (MC) with 29 subjects (55.4 ± 8.1 years). Subsequently, regardless of location, the groups were divided into Active and Insufficiently Active so their	Among stroke survivors in Brazil, it was found that active patients have a significantly higher quality of life. However, this was found not to be significant in affecting the overall HDI of the area.

Nuno Garrido and Robert Hickner and Victor Reis		difference in terms of quality of life could be analyzed. Results: There were no significant differences between BH and MCG when it came to four dimensions of physical health that were evaluated (physical functioning, physical aspect, pain and health status) or in the following four dimensions of mental health status (vitality, social aspect, emotional aspect and mental health). However, significantly higher mean values were found in Active when compared with Insufficiently Active individuals in various measures of physical health (physical functioning 56.2 ± 4.4 vs. 47.4 ± 6.9; physical aspect 66.5 ± 6.5 vs.59.1 ± 6.7; pain 55.9 ± 6.2 vs. 47.7 ± 6.0; health status 67.2 ± 4.2 vs. 56.6 ± 7.8) (arbitrary units), and mental health(vitality 60.9 ± 6.8 vs. 54.1 ± 7.2; social aspect 60.4 ± 7.1 vs. 54.2 ± 7.4; emotional aspect 64.0 ± 5.5 vs. 58.1 ± 6.9;mental health status 66.2 ± 5.5 vs. 58.4 ± 7.5) (arbitrary units). Conclusions: Despite the difference between the cities concerning HDI values, no significant differences in quality of life were found between BH and MCG. However, the Active group showed significantly better results, confirming the importance of active lifestyle to enhance quality of life in stroke survivors."	
Pucci, Gabrielle and Cassiano Rech and Rogerio Fermino and Rodrigo Reis	Association Between Physical Activity and Quality of Life for Adults	"The objective of this study is to analyze evidences of the association between physical activity and quality of life. 38 Studies were selected and it was concluded that there is a positive association between physical activity and quality of life."	There is a positive association between physical activity and quality of life.

Romain, A.J. and P. Bernard and V. Attalin and C. Gernigon and G. Ninot and A. Avignon	Health-related Quality of Life and Stages of Behavioral Change for Exercise in Overweight /Obese Individuals	"Background. – Stages of change in exercise behavior have been s hown to be associated with health related quality of life (HRQoL) in overweight/obese adults. However, studies examin ing this relationship have not used questionnaires s pecifically designed for such a population. The present study assessed the impact of stages of change (SOC) for exercise, using the trans theoretical model, on the HRQoL, using the Qualit yof Life, Obesity and Dietetics (QOLOD) scale, an obesity specific QoL questionnaire. Our hypothesis was that the more people are in the advanced stages of behavioral change, the better their HRQoL.Methods. A total of 214 consecutive obese individuals (148 women/66 men, mean age 47.4 ± 14.0 years, BMI 37.2 ± 8.4 kg/m2) were inc luded in the cross sectional study, and all completed SOC and QOLOD questionnaires. Multivariate analysis of covariance (MANCOVA) established significant effects on the overall comp osite of the five dimensions of theQOLOD ($P < 0.001$). Analysis of covariance (ANCOVA) further d etermined the significant effect of SOC in terms of physical impact ($P < 0.001$) and psychosocial impact ($P < 0.01$), with marginally significant effe cts on sex life ($P = 0.07$), but no impact on comfor t with food ($P = 0.13$) or on the dieting experience ($P = 0.13$), two dimensions evaluating attitudes toward food. In obese/overweight individuals, the HRQoL varies with the SOC, with those in the more advanced behavioral stages repo rting better HRQoL. However, dimensions related to food showed no differences according to SOC, c onfirming the complexity of the relationship between exercise and nutrition, and the need for fu rther studies to acquire a more complete understan ding of their underlying mechanisms."	In overweight individuals, the quality of life improves with increased exercise, but it is a complex relationship. As people become less obese, their quality of life depends less on exercise and more on nutrition.

Schlosser, Eric	Fast Food Nation: What the All-American Meal is Doing to the World	"This is a book about fast food, the values it embodies, and the world it has made. Fast food has proven to be a revolutionary force in American life; I am interested in it both as a commodity and as a metaphor. What people eat (or don't eat) has always been determined by complex interplay of social, economic, and technological forces. The early Roman Republic was fed by its citizen-farmers; the Roman Empire, by its slaves. A nation's diet can be more revealing than its art or literature. On any given day in the United States about one-quarter of the adult population visits a fast food restaurant. During a relatively brief period of time, the fast food industry has helped to transform not only the American diet, but also our landscape, economy, workforce, and popular culture. Fast food and its consequences have become inescapable, regardless of whether you eat it twice a day, try to avoid it, or have never taken a single bite."	Fast food chains are a symbol of westernization and economic development. As more fast food chains pop up, the human development index is also increasing.
Adams, Ronald	Fast Food, Obesity, and Tort Reform: An Examination of Industry Responsibility for Public Health	"The first section of this paper briefly examines current definitions and measures of obesity. Obesity rates and trends are described, along with a brief discussion of attendant public health concerns. Healthcare costs associated with obesity are also examined. The second section of the paper outlines the bases for establishing industry responsibility for obesity as articulated in litigation against fast-food chains like McDonald's and Wendy's. The final section of the paper focuses on questions of social responsibility and tort reform."	Explains that fast food has a significant influence on both obesity and health. Additionally, obesity has a huge correlation with poor health.
Alkire, Sabina	Dimensions of Human Development	"If human development is ''multidimensional'' then perhaps we need to discuss what we mean by multidimensional: what is a dimension, and what are the multiple dimensions of interest? This paper develops an account of dimensions of human development, and shows its usefulness and its limitations—both in general and in relation to Amartya Sen's capability approach. The second half of the paper surveys other major ''lists'' of dimensions that have been published in poverty studies, cross-cultural psychology, moral philosophy, quality of life indicators, participatory development, and basic needs, and compares and contrasts them with the account sketched here."	Both play, including enjoying recreational exercising and activities, and health are significant influences of the human development index at the country level.

Bauman, Adrian and Fiona Bull and Tien Chey and Cora Craig and Barbara Ainsworth and James Sallis and Heather Bowles and Maria Hagstromer and Michael Sjostrom and Michal Pratt	The International Prevalence Study on Physical Activity: Results from 20 Countries	"Background: Physical activity (PA) is one of the most important factors for improving population health, but no standardized systems exist for international surveillance. The International Physical Activity Questionnaire (IPAQ) was developed for international surveillance. The purpose of this study was a comparative international study of population physical activity prevalence across 20 countries. Methods: Between 2002–2004, a standardized protocol using IPAQ was used to assess PA participation in 20countries [total N = 52,746, aged 18–65. Results: The prevalence of "high PA" varied from 21–63%; in eight countries high PA was reported for over half of the adult population. The prevalence of "low PA" varied from 9% to 43%. Males more frequently reported high PA than females in 17 of 20 countries. The prevalence of low PA ranged from 7–41% among males, and 6–49%among females. Gender differences were noted, especially for younger adults, with males more active than females in most countries. Markedly lower physical activity prevalence (10% difference) with increasing age was noted in 11 of 19 countries for males, but only in three countries for women. The ways populations accumulated PA differed, with some reporting mostly vigorous intensity activities and others mostly walking. Conclusion: This study demonstrated the feasibility of international PA surveillance, and showed that IPAQ is an acceptable surveillance instrument, at least within countries. If assessment methods are used consistently overtime, trend data will inform countries about the success of their efforts to promote physical activity."	Percentage of people who participate in high levels of physical activity varies significantly based on where they live in the world. However, the average is from 21 to 63%, meaning that in most places the majority of people do not get enough physical activity.
Modranka, Emilia and Jadwiga Sucheck a	The Determinants of Population Health Spatial Disparities	"Health of the population is one of the basic factors of social development. The results of empirical studies indicate a number of factors determining the level of health of the population related to access to health care services, the level of environmental pollution and the wealth of society. It must be assumed that the observed disparities in the health depend on distributions of particular determinants. The aim of the article is to assess the significance of the main factors affecting the occurrence of spatial disparities in the	This article looks at the determinants of the health influence on the human development index. One of the most significant factors is the percentage of

		level of social development districts NTS-4 in terms of health of the population. The analysis was based on estimates of the Spatial Durbin Model (SDM) which takes into account the impact of neighborhood spatial units on level of dependent variable and the explanatory variables. The size of the level of social development in terms of health of the population in the study was approximate by the aggregate value of the index, which is the local component of the Local Human Development Index LHDI."	people that exercise at sports clubs. This study was done in regions of Poland.
Sjostrom, M. and P. Oja and M. Hagstromer and B. J. Smith and A. Bauman	Health-enhancing Physical Activity Across European Union Countries: the Eurobarometer Study	"The World Health Organization (WHO) recommends the development of comparable national physical activity surveillance systems to assess trends within and amongst countries as the Global Strategy for Diet and Physical Activity is implemented. To date, the lack of well-standardized measurement instruments has impeded such efforts, but new methodologies are being developed for this purpose. This paper describes the usefulness of the International Physical Activity Questionnaire (IPAQ) in population samples. The Special Eurobarometer Wave 58.22002 covered physical activity and provided a good vehicle for assessment of health-enhancing physical activity(HEPA) in the European Union. Data from around 1,000individuals in each of the 15 member states were collected after careful translation of the questionnaire. IPAQ scoring protocol version 2 was used for definition of activity categories. Data on the prevalence of sufficient total activity, sedentariness, frequent walking and sitting, in total and by gender across European Union (EU) countries showed consistent patterns. The prevalence of sufficient physical activity for health across the member countries was 29%. It ranged from 44% in the Netherlands to 23% in Sweden. The prevalence of sedentariness across countries was in general the mirror image. Regular walking was most prevalent in Spain. Gender was related to physical activity in that men were 1.6 times more likely than women to be sufficiently active, less likely to be sedentary and slightly more likely to sit for at least 6 hours daily. The findings suggest that two thirds of the adult populations of	Based on the World Health Organization recommendations, only about one third of the population of European countries are sufficiently active.

		the European countries are insufficiently active for optimal health benefits. As the IPAQ measurement provides information about the patterns of total physical activity and inactivity, the findings indicate possibilities for targeted health promotion efforts."	
Ko, Gary	Both Obesity and Lack of Physical Activity are Associated with a Less Favorable Health-related Quality of Life in Hong Kong Chinese	"Purpose. To investigate the relationships among obesity, physical activity and quality of life(QOL) in Hong Kong Chinese adults. Methods. A cross-sectional study involving 876 subjects (32.9% men and 67.1% women, mean age: 34.8 6 7.9 years) from a no manual working population. The Medical Outcome Study Short Form 36 (SF-36, Chinese version) was used for health-related QOL. Level of physical activity was assessed with self-reported questionnaire. Obesity was defined as body mass index §25 kg/m2.Results. 31% of men and 9% of women were obese (overall 16.0%). Obese subjects had lower scores on some of the SF-36 subscales. As the level of physical activity decreased, mean scores on most SF-36 subscales also progressively decreased. Obese women who had no regular physical activity had lower scores on some QOL subscales than obese women who had some regular physical activity. Discussion. Among this Hong Kong Chinese sample, both obesity and lack of physical activity are associated with lower scores on QOL."	This study determines how obesity and physical activity related to quality of life in Hong Kong Chinese adults. Results show that both increased obesity and high physical inactivity lead to a lower quality of life.
Haapanen-Niemi, N and S Miilunpalo, and M Pasanen and I Vuori and P Oja and J Malmberg	Body Mass Index, Physical Inactivity and Low Level of Physical Fitness as Determinants of All-Cause and Cardiovascular Disease Mortality-16 Y Follow-up of Middle-	"The objective of this study is to investigate the independent associations and the possible interaction of body mass index (BMI), leisure time physical activity (LTPA) and perceived physical fitness and functional capability with the risk of mortality. The subjects are a regionally representative cohort of 35 ± 63 -y-old Finnish men and women. All-cause, cardiovascular disease (CVD) and coronary heart disease (CHD) mortality were derived from the national census data until the end of September 1996 while the initial levels of BMI, LTPA, physical fitness and function were determined from self-administered questionnaires. After adjustment for age, marital and employment status, perceived health status, smoking and alcohol consumption, the Cox proportional hazards model showed that BMI was not associated with the risk of death among the	Physical fitness is shown to be a independent risk factor for mortality from cardiovascular diseases, coronary heart disease, and all acauses combined. Specifically, this study analyzes whether the exercise of a person is perceived as better, similar, or worse than others

	aged and Elderly Men and Women	men or the women. Compared with the most active subjects the men and women with no weekly vigorous activity had relative risks of 1.61 (95% confidence interval, CI, 0.98 ± 2.64) and 4.68 (95% CI, 1.41 ± 15.57), respectively, for CVD mortality, and for the men there was a relative risk of 1.66 (95% CI, 0.92 ± 2.99) for CHD mortality. When compared with the men who perceived their fitness as better than their age-mates, the men with the `worse' assessment had a relative risk of 3.29 (95% CI, 1.80 ± 6.02) for all-cause mortality and 4.37 (95% CI, 1.80 ± 10.6) for CVD mortality. Men with at least some difficulty in walking a distance of 2 km had a relative risk of 1.62 (95% CI, 1.05 ± 2.50) for all-cause mortality when compared with those who had no functional difficulties. In addition, in the comparison with subjects with no functional difficulties, the men and women who had some difficulty climbing several flights of stairs had relative risks of 1.47 (95% CI, 0.97 ± 2.23) and 2.39 (95% CI, 1.25 ± 4.60) for all-cause mortality, respectively. For CVD mortality the relative risks were 1.85 (95% CI, 1.04 ± 3.30) and 3.38 (1.22 ± 9.41), respectively. CONCLUSIONS: Although BMI did not prove to be an independent risk factor for mortality from CVD, CHD or from all causes combined, perceived physical fitness and functional capability did. An increase in LTPA seems to have a similar beneficial effect on the mortality risk of obese and non-obese men and women."	in their age category.
U.S. Department of Health and Human Services	Chapter 4: The Effects of Physical Activity on Health and Disease	"This chapter examines the relationship of physical activity and cardiorespiratory fitness to a variety of health problems. The primary focus is on diseases and conditions for which sufficient data exist to evaluate an association with physical activity, the strength of such relationships, and their potential biologic mechanisms. Because most of the research to date has addressed the health effects of endurance type physical activity (involving repetitive use of large muscle groups, such as in walking and bicycling), this chapter focuses on that type of activity."	Summary of other articles with findings linking physical activity to disease and a lower overall health

Bize, Raphael and Jeffrey Johnson and Ronald Plotnikoff	Physical Activity Level and Health-Related Quality of Life in the General Adult Population: A Systematic Review	"Objective. Little is known regarding health-related quality of life and its relation with physical activity level in the general population. Our primary objective was to systematically review data examining this relationship. Methods. We systematically searched MEDLINE, EMBASE, CINAHL, and PsycINFO for health-related quality of life and physical activity related keywords in titles, abstracts, or indexing fields. Results. From 1426 retrieved references, 55 citations were judged to require further evaluation. Fourteen studies were retained for data extraction and analysis; seven were cross-sectional studies, two were cohort studies, four were randomized controlled trials and one used a combined cross sectional and longitudinal design. Thirteen different methods of physical activity assessment were used. Most health-related quality of life instruments related to the Medical Outcome Study SF-36 questionnaire. Cross-sectional studies showed a consistently positive association between self-reported physical activity and health-related quality of life. The largest cross-sectional study reported an adjusted odds ratio of "having 14 or more unhealthy days" during the previous month to be 0.40 (95% Confidence Interval 0.36–0.45) for those meeting recommended levels of physical activity compared to inactive subjects. Cohort studies and randomized controlled trials tended to show a positive effect of physical activity on health-related quality of life, but similar to the cross-sectional studies, had methodological limitations. Conclusion. Cross-sectional data showed a consistently positive association between physical activity level and health-related quality of life. Limited evidence from randomized controlled trials and cohort studies precludes a definitive statement about the nature of this association."	There is a consistently positive correlation between physical activity level and quality of life in past studies.

Appendix B: Data

Fips	County	HDI	INAC	OBES	EXER	FAST	AFRI	HISP
18001	Adams County	48.9495	28.8	32.8	56.3003	0.46559	0.65155	4.27706
18003	Allen County	69.7088	23.3	30.1	81.8250	0.65480	11.7609	6.82844
18005	Bartholomew County	66.6096	25.5	29.5	62.0347	1.16265	1.92425	6.25349
18007	Benton County	55.6812	28.2	32.6	46.0131	0.56792	0.74914	5.20998
18009	Blackford County	38.0724	29.7	36	56.1021	0.47992	0.58047	1.30407
18011	Boone County	80.4891	22.2	27.8	80.5226	0.66164	1.28447	2.44573
18013	Brown County	54.0701	30.2	30.6	51.2006	0.1326	0.20565	1.40639
18015	Carroll County	59.7750	32.4	26.9	61.9300	0.59716	0.31393	3.90173
18017	Cass County	50.5440	29.8	33.7	71.4417	0.80350	1.49754	13.2352
18019	Clark County	51.9374	30.4	33.3	83.7370	0.73246	6.89944	4.98164
18021	Clay County	45.4366	26.8	33.1	67.0992	0.63345	0.32839	1.25760
18023	Clinton County	50.0111	31	30.9	62.4939	0.69650	1.02767	14.0782
18025	Crawford County	24.1730	27.8	33	67.2080	0	0.27240	1.40898
18027	Daviess County	37.5162	32.3	37.6	63.1098	0.59256	1.26259	4.39420
18029	Dearborn County	60.8091	27.2	32.5	71.0652	0.42142	0.71629	1.11557
18031	Decatur County	58.9776	31.4	32.7	62.3387	0.76799	1.22932	1.78079
18033	DeKalb County	58.5775	24.3	32.8	69.3579	0.61435	0.16067	2.54483
18035	Delaware County	57.1746	29.2	31.5	76.7504	0.57087	5.36439	1.9695
18037	Dubois County	68.9949	21.9	29.5	72.6014	0.83192	0.34858	6.31728
18039	Elkhart County	60.9846	25.9	32.8	66.1615	0.64122	5.75913	14.6083
18041	Fayette County	29.7747	34.2	33	63.9247	0.87394	1.68232	0.97683
18043	Floyd County	63.8057	29.4	30.1	92.1572	0.85012	4.82295	2.79725
18045	Fountain County	42.3893	28.8	29.8	61.2065	0.64256	0.43524	2.36442
18047	Franklin	49.1893	25.6	26.2	45.6014	0.65305	0.20017	1.02698

	County							
18049	Fulton County	49.2828	24.3	37.8	36.9168	0.67512	1.05145	4.65645
18051	Gibson County	66.0678	29.2	32.1	64.5196	0.56787	1.73584	1.46787
18053	Grant County	48.2904	30.3	37.3	45.3305	0.66349	6.63367	3.83333
18055	Greene County	43.0970	29.2	33.1	43.2293	0.69823	0.28807	1.13408
18057	Hamilton County	100	16.3	25.9	91.3599	0.74958	3.49127	3.62381
18059	Hancock County	74.6614	26.8	34.8	64.3138	0.57801	1.95904	1.89552
18061	Harrison County	45.2623	28.5	36	33.5865	0.56217	0.55589	1.64728
18063	Hendricks County	71.9773	24.3	31.8	77.2688	0.77110	5.47699	3.28526
18065	Henry County	42.9207	28.8	36.7	66.1639	0.48637	1.61293	1.54793
18067	Howard County	58.9086	28	31.4	73.3142	0.78456	7.04947	2.89456
18069	Huntington County	59.5785	26.5	32.6	82.3618	0.75702	0.68995	1.90210
18071	Jackson County	47.4148	31.4	36.9	67.0827	0.78917	0.60750	6.02870
18073	Jasper County	60.6797	28.1	29.6	57.5631	0.5978	0.97180	5.66037
18075	Jay County	44.0779	32.5	34	37.8581	0.46803	0.49344	2.88547
18077	Jefferson County	48.0829	30	35	69.2241	0.6758	2.07415	2.38234
18079	Jennings County	42.3463	32.8	33	53.2620	0.42612	0.98855	2.20741
18081	Johnson County	66.4691	22	30.2	86.9993	0.87296	1.87775	3.27980
18083	Knox County	61.0942	32.4	32.3	69.8022	0.68202	3.14292	1.72860
18085	Kosciusko County	66.8719	23.2	33.2	70.1634	0.69579	0.78673	7.65908
18087	LaGrange County	0	26.2	34.2	32.0485	0.29316	0.05561	3.76069
18089	Lake County	59.2913	30.1	33.9	91.4740	0.81439	25.2486	17.4001
18091	LaPorte County	48.1739	23.9	35	72.8000	0.62923	10.5711	5.76945
18093	Lawrence County	41.9516	30.6	38.2	76.5010	0.49915	0.36980	1.42484
18095	Madison County	42.0499	26	33.4	70.5961	0.57538	7.20265	3.43336

18097	Marion County	60.0922	25.6	32.4	89.8285	0.87162	26.9015	9.59072
18099	Marshall County	56.1764	26.2	30.8	63.3397	0.95695	0.80796	8.97261
18101	Martin County	54.8666	30.8	35.8	61.3412	1.07212	0.18457	0.37886
18103	Miami County	45.4277	30.1	35.7	55.5483	0.54815	4.99807	2.5746
18105	Monroe County	85.5425	19.6	22.1	88.0455	0.76585	2.94469	3.15093
18107	Montgomery County	55.5516	25.8	32.7	63.5977	0.73195	1.06068	4.52557
18109	Morgan County	55.0794	29.4	33.2	63.9228	0.47580	0.31437	1.32673
18111	Newton County	51.0626	32.4	35.3	35.3973	0.78325	0.19802	5.54455
18113	Noble County	50.2412	25.8	31.8	57.8130	0.50439	0.34318	9.79219
18115	Ohio County	0	29	30.4	67.5913	0.16450	1.84422	0.46105
18117	Orange County	37.6245	30.3	35.4	63.3971	0.50787	1.4426	1.16420
18119	Owen County	46.6777	27.7	34	44.7045	0.28063	0.60034	1.09281
18121	Parke County	43.6825	32.4	33.6	32.9892	0.23434	2.24418	1.30232
18123	Perry County	41.4840	28.5	32.8	84.7140	0.66796	3.00740	1.15155
18125	Pike County	50.6050	29.4	36.4	12.9933	0.54833	0.18063	0.07068
18127	Porter County	80.3523	23.9	31.9	82.7805	0.71220	3.45075	9.00319
18129	Posey County	80.3602	26.1	29.1	47.7113	0.31251	1.11930	1.01790
18131	Pulaski County	52.3491	29	31.5	35.3081	0.76196	0.41127	2.68088
18133	Putnam County	60.5719	30.8	31.5	48.8475	0.50331	4.04209	1.71490
18135	Randolph County	55.3566	29.6	35.6	33.2123	0.38737	0.41083	3.13166
18137	Ripley County	55.1132	26.1	32.7	71.6982	0.52478	0.47900	1.60833
18139	Rush County	54.1132	33.9	32.6	32.0434	0.58496	0.93894	1.21304
18141	St. Joseph County	69.1453	25	30	81.6623	0.75466	12.9437	7.72827
18143	Scott County	0	34.1	29.5	47.0286	0.75658	0.55655	1.64455
18145	Shelby County	54.6009	32.8	33.1	53.7402	0.62962	1.14117	3.79040
18147	Spencer	54.1809	27.5	30.5	50.3913	0.38393	0.69879	2.60852

	County							
18149	Starke County	22.2691	30.6	36.1	54.5178	0.43079	0.46952	3.41589
18151	Steuben County	61.2832	28.9	33.7	48.5768	0.70331	0.68733	3.09739
18153	Sullivan County	37.9577	33.5	32.9	30.3702	0.47196	5.29514	1.63
18155	Switzerland County	29.5838	30	32	18.8165	0.38373	0.22826	1.55982
18157	Tippecanoe County	82.0029	22.2	26.4	71.8092	0.74924	4.35680	7.80138
18159	Tipton County	59.5798	26	31.1	37.7823	0.57343	0.27409	2.47322
18161	Union County	51.6703	34	30	55.7876	0.67916	0.27092	0.43348
18163	Vanderburgh County	64.5989	26.8	33.3	85.5328	0.90678	9.09679	2.35740
18165	Vermillion County	49.0937	31.3	33.1	49.8766	0.62344	0.25075	1.00300
18167	Vigo County	54.7259	27.2	32.8	74.2814	0.78393	6.50631	2.43386
18169	Wabash County	57.2848	34.4	31.6	57.1880	0.80343	0.54167	2.24055
18171	Warren County	59.6787	24.5	32.1	41.0437	0.11987	0.10687	1.12813
18173	Warrick County	73.2539	25.2	29.4	81.2528	0.41347	1.49492	1.66341
18175	Washington County	32.0478	28.7	30.6	42.4421	0.35815	0.38191	1.27779
18177	Wayne County	49.1468	30.2	29.6	72.7454	0.65841	4.60942	2.65359
18179	Wells County	65.8406	25.9	28.4	52.9382	0.54245	0.31732	2.30059
18181	White County	57.0022	26.5	34.7	34.0015	0.69598	0.18378	7.38411
18183	Whitley County	63.2792	26.1	32	63.3065	0.62983	0.32425	1.76539

Appendix C: Stata Regressions

Unrestricted Equation

```
. summ hdi inac obes exer fast afri hisp
```

Variable	Obs	Mean	Std. Dev.	Min	Max
hdi	92	53.1822	16.42121	0	100
inac	92	28.16848	3.454474	16.3	34.4
obes	92	32.36304	2.807749	22.1	38.2
exer	92	60.52003	17.54564	12.99338	92.1572
fast	92	.6121086	.1994014	0	1.162658
afri	92	2.642111	4.438404	.0556159	26.90159
hisp	92	3.607102	3.301559	.0706825	17.40013

```
. reg hdi inac obes exer fast afri hisp
```

Source	SS	df	MS			
				Number of obs	=	92
				F(6, 85)	=	11.13
Model	10794.0273	6	1799.00455	Prob > F	=	0.0000
Residual	13744.6675	85	161.701971	R-squared	=	0.4399
				Adj R-squared	=	0.4003
Total	24538.6949	91	269.655987	Root MSE	=	12.716

hdi	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inac	-1.925819	.4567428	-4.22	0.000	-2.833946	-1.017692
obes	-1.156742	.5337333	-2.17	0.033	-2.217946	-.0955366
exer	.0706287	.0996062	0.71	0.480	-.1274151	.2686725
fast	21.90138	7.632943	2.87	0.005	6.725045	37.07771
afri	.0340166	.3761013	0.09	0.928	-.7137736	.7818067
hisp	.0349751	.4834643	0.07	0.942	-.9262816	.9962317
_cons	126.9687	20.60782	6.16	0.000	85.99489	167.9426

```
. corr hdi inac obes exer fast afri hisp
(obs=92)
```

	hdi	inac	obes	exer	fast	afri	hisp
hdi	1.0000						
inac	-0.5524	1.0000					
obes	-0.4190	0.4156	1.0000				
exer	0.4091	-0.4038	-0.2877	1.0000			
fast	0.3727	-0.1194	-0.1158	0.4015	1.0000		
afri	0.1842	-0.1441	-0.0119	0.4687	0.2840	1.0000	
hisp	0.2204	-0.2145	-0.0293	0.2842	0.3566	0.4759	1.0000

Restricted Equation

```
. reg hdi inac obes fast
```

Source	SS	df	MS			
				Number of obs	=	92
				F(3, 88)	=	22.60
Model	10679.0563	3	3559.68544	Prob > F	=	0.0000
Residual	13859.6385	88	157.495892	R-squared	=	0.4352
				Adj R-squared	=	0.4159
Total	24538.6949	91	269.655987	Root MSE	=	12.55

hdi	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inac	-2.051737	.4200125	-4.88	0.000	-2.886424	-1.217051
obes	-1.199929	.5165355	-2.32	0.022	-2.226435	-.1734235
fast	24.48731	6.663073	3.68	0.000	11.24585	37.72876
_cons	134.821	17.15308	7.86	0.000	100.7329	168.9091

```
. corr hdi inac obes fast
(obs=92)
```

	hdi	inac	obes	fast
hdi	1.0000			
inac	-0.5524	1.0000		
obes	-0.4190	0.4156	1.0000	
fast	0.3727	-0.1194	-0.1158	1.0000